CLAIMS

What is claimed is:

1. An x-ray tube comprising:

(a) a vacuum enclosure;

(b) means for emitting electrons according to a predetermined emission profile, the means for emitting electrons according to a predetermined emission profile being substantially disposed within the vacuum enclosure; and

(c) an anode positioned within the vacuum enclosure so as receive electrons emitted by the means for emitting electrons according to a predetermined emission profile.

2. The x-ray tube as recited in Claim 1, wherein the means for emitting electrons according to a predetermined emission profile comprises a filament and a cathode cup including two walls which cooperate to at least partially define a slot wherein the filament is at least partially disposed, a distance between the filament and the at least one wall varying along at least a portion of the longitudinal length of the filament.

3. The x-ray tube as recited in Claim 2, wherein the distance between said filament and at least one of the at least two walls is at a minimum proximate a middle portion of the filament.

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4. The x-ray tube as recited in Claim 2, wherein the distance between the filament and at least one of the at least two walls is at a maximum proximate at least one end portion of the filament.

5. The x-ray tube as recited in Claim 2, wherein the at least two walls of the slot are of substantially the same shape and are symmetrically disposed with respect to the filament.

6. An x-ray tube as defined in Claim 2, wherein the slot further comprises a bottom surface, and wherein the at least two walls are perpendicularly disposed with respect to the bottom surface.

7. The x-ray tube as recited in Claim 2, wherein the slot defines a cross-section having a least two different widths.

8. The x-ray tube as recited in Claim 2, wherein the means for emitting electrons according to a predetermined emission profile comprises a filament configured such that at least one of the properties of the filament varies along at least a portion of a longitudinal length of the filament, wherein the properties of the filament are selected from the group consisting of: filament wire diameter, pitch, filament diameter.

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9. The x-ray tube as recited in Claim 2, wherein the means for emitting electrons according to a predetermined emission profile comprises a cathode cup including two walls which cooperate to at least partially define a slot, the slot having a cross sectional area that varies along at least a portion of a length of the slot.

10. The x-ray tube as recited in claim 1, wherein the means for emitting electrons according to a predetermined emission profile produces an emission profile wherein a density of emitted electrons per unit area is substantially uniform throughout a predefined plane through which a substantial portion of the emitted electrons pass.

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11. A cathode assembly suitable for use in an x-ray device, the cathode assembly comprising:

(a) a base portion;

(b) a cathode cup attached to the base portion, the cathode cup including at least two walls which cooperate to at least partially define a slot; and

(c) a filament disposed substantially within the slot.

12. The cathode assembly as recited in claim 11, wherein the filament comprises a helically wound wire having at least two different diameters.

13. The cathode assembly as recited in claim 11, wherein the filament defines at least two different pitches.

14. The cathode assembly as recited in claim 11, wherein the filament defines at least two different diameters.

15. The cathode assembly as recited in claim 11, wherein the slot at least partially defined by the walls of the cathode cup has a cross sectional area that varies along at least a portion of a length of the slot.

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16. The cathode assembly as recited in claim 11, wherein the slot at least partially defined by the walls of the cathode cup has a cross sectional area that varies along at

least a portion of a length of the slot, and wherein at least one of the properties of the filament varies along at least a portion of a longitudinal length of the filament, the properties of the filament being selected from the group consisting of: filament wire diameter, pitch, filament diameter.

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17. In an x-ray tube having a filament of predetermined longitudinal length, a method for producing an electron stream having a predetermined electron density profile, the method comprising:

(a) applying a predetermined electric current to the filament so as to cause emission of electrons by the filament;

(b) varying, with respect to the longitudinal length of the filament, the rate at which electrons are emitted by the filament; and

(c) accelerating at least some of the emitted electrons toward a focal spot located at a predetermined distance from the filament.

18. The method as recited in claim 17, wherein varying the rate at which electrons are emitted comprises varying an electrical field strength in selected areas proximate the filament.

19. The method as recited in claim 17, wherein varying the rate at which electrons are emitted comprises heating the filament in such a way that some portions of the filament are at a relatively higher temperature than other portions of the filament.

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20. In an x-ray tube including a filament of predetermined longitudinal length, a method for emitting electrons according to a predetermined emission profile, the method comprising:

(a) applying a predetermined electric current to the filament so as to cause emission of electrons by the filament; and

(b) varying, with respect to the longitudinal length of the filament, the rate at which electrons are emitted by the filament.

21. The method as recited in claim 20, wherein varying the rate at which electrons are emitted comprises varying an electrical field strength in at least one selected area proximate the filament.

22. The method as recited in claim 20, wherein varying the rate at which electrons are emitted comprises heating the filament in such a way that some portions of the filament are at a relatively higher temperature than other portions of the filament.

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23. A filament for use in the cathode of an x-ray tube, the filament having a longitudinal length and being disposed in a slot defined in the cathode, the filament comprising:

(a) a wire wound into successive coils to form a helix, the helix comprising a middle portion and first and second end portions, wherein at least one of a group of properties varies along at least a portion of a longitudinal length of the filament, the group of properties consisting of: wire diameter, pitch, filament diameter; and

(b) first and second electrical leads, the first electrical lead being attached to the first end portion of the helix, and the second electrical lead being attached to the second end portion of the helix.

24. The filament as recited in Claim 23, wherein the pitch is greatest in the middle portion of the helix.

25. The filament as recited in Claim 23, wherein the wire diameter is greatest in the middle portion of the helix.

26. The filament as recited in Claim 23, wherein the filament diameter is greatest in the middle portion of the helix.

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27. A cathode cup suitable for use in conjunction with a filament, the cathode cup comprising:

(a) at least two integral walls that cooperate to define a slot of predetermined length, the slot having a cross-sectional area that varies along at least a portion of the predetermined length; and

(b) first and second dielectric support posts.

28. The cathode cup as recited in claim 27, wherein the slot is wider at one end than at the other end.

29. The cathode cup as recited in claim 27, wherein the slot is wherein the slot is wider at both ends than in the middle.

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